Massachusetts Space Grant Consortium

Massachusetts Institute of Technology (Lead Institution)
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http://web.mit.edu/masgc/www/index.shtml
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The MA Space Grant Consortium (MASGC) is a Designated Consortium funded at a level of $845,000 for fiscal year 2010

PROGRAM GOALS

Outcome 1 Goals and Objectives: Contribution to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals.

1.1 Faculty and Research Support – Provide support to faculty, researchers and post-doctoral fellows by supporting students to work with them on research projects.
1.2 Student Support – Provide NASA competency-building education and research opportunities by way of research fellowships to the maximum number of Massachusetts students, as possible, to prepare them for employment at NASA, the aerospace industry, and higher education.
1.3 Student Involvement in Higher Education – Provide opportunities for groups of post-secondary students to engage in authentic NASA-related mission-based R&D activities, by recruiting the best students from our consortium to participate in NASA programs.
1.4 Course Development – Develop and put into practice university-level academic course resources at MASGC affiliate institutions.
1.5 Targeted Institution Research and Academic Infrastructure – Leverage research funding in the state to enable institutions to conduct cutting edge research and development work for NASA.

Outcome 2 Goals and Objectives:
Attract and retain students in STEM disciplines through a progression of educational opportunities for students and teachers.

2.1 & 2.2 Educator Professional Development (short- and long-term) – Provide continuing in-service opportunities to help teachers maintain competency in STEM instruction and encourage teachers to incorporate STEM instruction in their classrooms.
2.3 Curricular Support Resources – Ensure that Massachusetts's teachers and students know how to access the wealth of available NASA educational materials.
2.4 Student Involvement (K-12) – Encourage and enable students to feel a personal connection with NASA missions.
2.5 Diversity – Extend Space Grant programs and opportunities to the broadest possible cross-section of the Massachusetts population, particularly encouraging, participation by women and minorities.

Outcome 3 Goals and Objectives:
Build strategic partnerships and linkages between STEM formal and informal education providers that promotes STEM literacy and awareness of NASA's mission.

3.1 Resources – Assist our informal education affiliates in enhancing STEM proficiency, publicizing STEM career opportunities, and educating about NASA's mission activities.
3.2 Professional Development for Informal Education Providers –Recognize the important role played by informal educators by supporting them as we do teachers in incorporating STEM activities into their programs.
3.3 Informal Education Provider Involvement Opportunities – Help MASGC's outreach partners present the full breadth and depth of NASA's missions to Massachusetts's informal educators.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

OUTCOME 1
Higher education is at the top of our priorities and received the largest allocation in our budget. We awarded almost all higher education funding as fellowships, given directly to students, which avoids institutional overhead charges. Although our proposed amount for fellowships is in excess of the mandatory requirements by Space Grant, it is the wisest use of Space Grant resources, given the large higher education establishment in Massachusetts. Further, faculty, researchers and post-doctoral fellows in Massachusetts have traditionally been extremely successful in attracting NASA research funding. Therefore, MASGC has made a major policy decision not to act as an alternate source of direct NASA research funding for faculty. Instead of funding a small number of large research grants (formerly done as sub-contracts to a few MASGC affiliates), MASGC now distributes most of its research and higher education funding as small research fellowship grants to students, each of whom is sponsored by a faculty member or researcher at an affiliate institution.

This makes the maximum impact in meeting the objectives of this outcome as evidenced by a poignant note from a senior at UMass:

"Being from a family with very little money (it's just my mother and I, and she has Multiple Sclerosis and cannot work), it was always very difficult to do things that I enjoy. I was always

very interested in relativity and physics as well as computers, but always had to have a low paying hourly job to support myself. After being awarded the Space Grants, I have been able to avoid having a meaningless hourly job and spend my time working with my advisor learning things that most people my age have never even heard of. Had I never been awarded my first Space Grant, my entire collegiate experience would have been drastically different and much less rewarding. Due to the awards, I have become extremely proficient in GPU programming and parallel computing; both of which will make me infinitely more valuable when I enter the work force."

Justin McKennon, Senior, UMass/Dartmouth

MASGC continued to recruit the very best students from the state for NASA programs. On the average, MASGC has supported 3 students each year at the NASA Academies and has provided staff support every year for final academy selections. MASGC continues to make special efforts to attract minority students to these programs.

MASGC has advertised its program opportunities as widely as possible, to attract students from diverse backgrounds from all of our member institutions. The Consortium's members include Holyoke Community College, which serves a large number of economically disadvantaged students, and Roxbury Community College; the only designated "minority-serving institution" in the state. Attracting community college students to space-related activities is challenging, because space is a field of endeavor most of the students have not thought about. Therefore, MASGC offered fellowships and a STEM seminar series to community college students, to encourage them to enter the aerospace workforce pipeline. It is, in effect, a "Scholarship for Service" program for the inner city minority population in Massachusetts.
The following are messages received from undergraduate and graduate students to evidence the impact of space grant funding in a number of ways ranging from continuing graduate research to choosing a career in aerospace:

"I was able to support myself with the Space Grant this summer while conducting research at UMass Amherst. My accomplishments this summer include performing various analyses on sediment cores taken from Florida, creating a preliminary model of the storm surge generated by Hurricane Dennis at my field sites, and establishing contacts at the USGS."

Christine Brandon – PhD, UMass/Amherst

"I will be working for the same lab that assigned me Space Grant funding. The internship worked out so well and I liked the work so much that I will be working on Mars Science Lab (ChemCam) full time for the duration of the mission, and then going to grad school. Without Space Grant funding, I would not have had this opportunity. Thank you!"

Marco Carmosino, Senior, Hampshire College

"Space Grant provided me with valuable research experience that helped prepare me for graduate school."

Howard Liles – Senior, MIT

"The Space Grant funding highly encourages me in my career plans. Because of the funding, I was able to spend full time focusing on my research, instead of working another job to pay living expenses. Working full time on starting a research project certainly gave me an advantage, because I am planning on publishing a scientific paper before I graduate."

Jake McCoy, Junior, UMass/Amherst

"The funding I received from the Space Grant was instrumental in assisting me through my Masters research. My experience with graduate research at a Masters level interested me in continuing to work towards a Ph.D. I hope to continue with academia thanks in large part to the support from the Space Grant. "

Maija Benitz, Masters, UMass/Amherst

"Helped me get more involved with solar system exploration and astrobiology efforts, which are the focus of my long-term plans."

Sukrit Ranjan, PhD, Harvard University

"My current job is working on the NASA GSFC SDO mission doing flight operations. I love the job and I am very indebted to Space Grant. My grant allowed me to be a part of the MSFC NASA Academy this past summer (when I had just graduated college and was still unemployed). This program exposed me to the many fields of the space industry, including the company I am currently working for; when we visited the Lockheed facility in Houston it inspired me to search for a job with the company. I am also fairly sure that I would not have gotten this job without the research experience afforded me by NASA Academy, especially the exposure to IDL programing language, which was a requirement for my current job. So, I am basically a walking talking advertisement for the program. Thank you!"

Emma Lehman, senior, Williams College

"The opportunity encouraged me to pursue research at the undergraduate level and spurred interest in continuing research as my academic career continues."

Ian Rooney, Senior, UMass/Dartmouth

"By providing me funding over the summer of 2010, the Space Grant enabled me to work several months on a difficult problem that I would have been unable to solve while working and supporting myself."

Arnold G. Sherrick, PhD, UMass/Amherst

"The funding I received allowed me to conduct fieldwork that formed the basis for my dissertation."

Steven Jaret, PhD, Harvard

"I was exposed to research experience, giving me an idea if graduate school is a path I may want to consider. The work I did sparked new interests in different fields/practices within engineering."

Brian McCarthy, Junior, Holyoke Community College

"I was able to afford housing, food and transportation during my summer internship. Because of this internship I am now in a position to obtain another internship this summer. Thank you."

Erica Jawin, Junior, Mt Holyoke College

"I am more confident in doing research now that I have spent two years participating in this internship."

Peter Panka, Senior, UMass/Amherst

"I don't yet have plans for after school, but this grant allowed to me to try out astronomy research. I enjoyed it and now I think I'd like to go into Astronomy."

Natalie Perry, Junior, Tufts University

"Space grant funding allowed me to spend my summer pursuing my interest in space vehicle research and development. Through space grant's funding I was able to work in MIT's Space Systems Lab and Draper Laboratory on an exciting project, which allowed me to gain valuable knowledge and experience in regards to the aerospace industry and aerospace research. This experience in turn allowed me to discover a specific area of study that I would enjoy most, which in turn has given me greater focus in planning the rest of my academic as well as future professional career."

Julian Lemus, Sophomore, MIT

"It gave me the opportunity to do research I want to do in graduate school and have the experience of actually working in a lab, which shows graduate schools that I have experience and skills in what they are looking for in a graduate student."

Sara Kelemencky, Senior, UMass/Amherst

"The Space Grant afforded the opportunity to continue research in my chosen field of astronomical instrumentation and exploration of extragalactic dust. It has assisted me in the completion of my degree, giving me the research experiences I need in order to become a productive scientist in the future."

Meredith Danowski, Phd, Boston University

"The Space Grant allowed me to continue pursuing my research towards my PhD throughout the summer without the distraction of having to hold a part-time job to support myself. Furthermore, the work performed during the space grant--particularly that done to integrate our vacuum chamber facility--was a necessary foundation for the experimental components of my current research."

Michael Morin, PhD, Worcester Polytechnic Institute

"My experience in the 2010 Propulsion Academy at Marshall Space Flight Center was extremely rewarding, as I participated in cutting edge research, gained further knowledge about the space industry, developed a network of contacts that will be useful throughout my career, and created friendships that will last a lifetime. The exposure I gained to the field of propulsion solidified my interest in propulsion technologies, and motivated me to further pursue propulsion projects. "

Marissa Good, Junior, MIT

PROGRAM ACCOMPLISHMENTS

Specific MASGC accomplishments relating to the Outcome 1, 2 & 3 are as follows:

OUTCOME 1

- Support of 117 students from 18 academic affiliates across the state. 44 of these were female.
- Recruiting and supporting 23 students for summer internships at NASA centers and JPL.
- Supporting 6 students to present papers on their Space Grant supported research at conferences on space science and engineering.
- Holding the "Modern Space Science and Engineering" seminar series open to all member institutions of MASGC. Through weekly seminars, students gain familiarity with the broad variety of scientific and technology experiments being carried out in space. They will learn about the complex engineering required to implement these experiments and appreciate the interaction of science and engineering in the space enterprise. Students attend the seminars for academic credit or as auditors.
- Co-sponsoring 12-part STEM series at the Roxbury Community College, which is attended by minority students to expose them to various STEM disciplines including aerospace.
- Supporting the NASA-OLIN Research program. Sixteen undergraduate Olin College engineering students participated in this program where they hear about a variety of possible projects from NASA scientists. Students select four projects. Each student works in a four-student team on each of two different projects. The program provides an opportunity for students to apply their skills to real-world problems. The work done by students can be continued in a following summer or put into everyday use at Goddard and other NASA facilities.
- Conducting the KSC JOIE program. The program provides engineering students with an opportunity to study the relationship between engineering design and operations in large engineering systems with long product life cycles, such as space systems. Following a study at MIT of NASA's systems engineering approach, students spend three weeks during January at the Kennedy Space Center (KSC) interacting with NASA engineers, technicians and contractors. Requires a group presentation to KSC management and a group paper.

OUTCOME 2

- Holding Space Day at the Boston Museum of Science, which was attended by 250 high school students. STS-130 Astronaut Nicholas Patrick told the students his thoughts on "What you need to do to become an astronaut?" His talk was followed by presentations by a number of space grant interns, who spoke to the high school audience about their own research or experience of working at NASA. We believe that this is a powerful message to high school students coming from college students that an education in aerospace and a career with NASA is possible, interesting and fun.
- Supporting ballooning activities at the, Kuss Middle School in Fall River, previously a NASA Explorer school, by enabling them to conduct balloon launches. The consortium

also funded teachers at the school to attend the National Science Teachers Conference to participate in professional development for science teachers.
The following is an excerpt from benefits to the teachers:
"Thanks to NASA Space Grant, I was recently able to attend the NSTA conference held in Baltimore, Maryland from Nov. 11- Nov. 13. I found it to be a valuable experience, one that every science teacher should have. I was busy every day from 8:00 am until at least 4:30pm, gaining as much experience as I could. I enjoyed every minute and can say that I immediately employed some ideas into my classroom the very next Monday." Sandra Sullivan, Kuss Middle School, Fall River, MA

- The Director presented to the Perkins School for the Blind to as a pre-orientation to the students attending NASA's space camp.
- The Co-Director worked with the Science Club for Girls, a program for inner city minority girls. MASGC shared in the funding of rocket workshops for the girls with local industry.
- The consortium has partnered with The MA workforce Board and the Community Foundation of North Central MA to provide funding to the Montachusett Regional Vocational School to participate in the SSEP Mission to fly their experiments aboard STS-135. About 1,400 students participated in hand on activities to build experiments in a competition to fly the experiment on the last shuttle mission! A science experiment focusing on microgravity and its affect on tooth decay, which was developed by four junior science students at the school, has been given the green light by the National Center for Earth and Space Science Education for the shuttle flight.

OUTCOME 3

- Participating in the Massachusetts STEM Summit.
- Partnering with NASA contractors and a number of aerospace companies to obtain industry internships for students in the summer. This is critical both for practical education for our students and for the workforce needs of the aerospace industry. MASGC advertises internship opportunities and helps recruit students.
- Holding the MASGC Annual Public Lecture, which brings prominent aerospace personalities and issues for information and discussion for consortium members and the general public. This year's speaker was Dr. Robert (Bobby) D. Braun, NASA Chief Technologist who gave a talk entitled: "*Investments in our Future: Exploring Space through Innovation and Technology*."

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking**:

Starting in 2006, MASGC has begun longitudinal tracking of students who have participated in the Consortium's programs. We have added extra time for support staff in our budget to support this activity. So far, most of our awardees are still in school. However, we have been tracking our students' career plans to get an estimate of whether they have plans for research, education or employment in space-related areas. Of the 279 students who have graduated, 137 are pursuing advanced STEM-related degrees, 7 are actively seeking STEM employment, 46 are employed by aerospace contractors, 14 are employed in non-aerospace STEM positions, 6 are employed by NASA/JPL, 4 are employed in K-12 STEM, 22 are employed in "other" STEM academic fields and 43 in non-STEM employment. Students that were supported in summer 2011 will be tracked next year.

- **Course Development:**

The consortium helped develop and provided speakers and funding for a 12 part STEM series at the Roxbury Community College which was attended on the average by 30 minority students to expose them to various STEM disciplines including aerospace.

- **Matching Funds:**

Almost all of MASGC's Higher Education and Research support takes the form of research fellowships. The total fellowship amount in our budget therefore significantly exceeded the $610,000 referred to in the guidelines as not requiring matching. The Consortium has received $1,060,112.36 in matching.

- **Minority-Serving Institutions:**

The Consortium's members include Roxbury Community College, the state's only designated "minority-serving institution". Attracting community college students to space-related activities is challenging, because space is a field of endeavor most of the students have not thought about. Therefore, MASGC offered fellowships and a STEM seminar series to community college students, to encourage them to enter the aerospace workforce pipeline. It is, in effect, a "Scholarship for Service" program for the inner city minority population in Massachusetts. We have continued to fund a student from Roxbury Community College to spend the summer at MIT or Draper Lab and hope that the student said that this experience will convince him or her to go on for a 4-year college program in engineering.

IMPROVEMENTS MADE IN THE PAST YEAR

MASGC has added three smaller or state institutions: UMass, Dartmouth, Bridgewater State and Worcester State as consortium members. We believe that this extends our reach across the state to a different group of student demographics, which helps the consortium to reach rural communities and those that do not have the benefits of contacts with aerospace activities available in and around Boston.

The Consortium competed successfully in NASA's 2010 Summer of Innovation program. This has helped to strengthen ties amongst the middle school programs conducted by our members and with the state. MASGC received acknowledgement (the kick-off event was hosted by MA governor Deval Patrick in the presence of NASA Administrator Charles Bolden) and, publicity from the state government and various other education establishments within the state.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Currently, the Massachusetts Space Grant Consortium has 19 academic affiliates and 3 institutional (outreach) affiliates, covering the entire state from Cape Cod to the Berkshires. Members are listed below, together with the name of each affiliate's representative to MASGC:

Academic Affiliates

Massachusetts Institute of Technology, Lead	Professor Jeffrey Hoffman
Amherst College (Amherst)	Professor George Greenstein*
Boston University (Boston)	Professor Supriya Chakrabarti
Bridgewater State University (Bridgewater)	Professor Martina Arndt

College of the Holy Cross (Worcester)	Professor Matthew Koss
Framingham State University	Dr. Mary Linscombe
Harvard University (Cambridge)	Professor Jonathan Grindlay
Holyoke Community College (Springfield)	Professor X.Ran Duan
Mount Holyoke College (South Hadley)	Professor Darby Dyar
Northeastern University (Boston)	Mr. Randal August
Olin College (Needham)	Professor Steve Holt
Roxbury Community College (Boston)	Dr. Kyrsis Rodriguez
Tufts University (Somerville)	Professors Marianne Vestergaard and Chris Rogers
University of Massachusetts (Amherst)	Professor Robert Hyers
University of Massachusetts (Dartmouth)	Professor Robert Fisher
Wellesley College (Wellesley)	Professor Kim McLeod
Williams College (Williamstown)	Professor Jay Pasachoff
Worcester Polytechnic Institute (Worcester)	Professor Nikolaos Gatsonis
Worcester State University (Worcester)	Professor Sudha Swaminathan

*Professor Greenstein also represents the Five-College Astronomy Department, which in addition to Amherst, Mount Holyoke and UMass, also includes Hampshire and Smith Colleges. MASGC's long-term goal is to make Hampshire and Smith full affiliate members in their own right, but this has not yet occurred.

Institutional Affiliates (Outreach)

Museum of Science (Boston)	Mr. Paul Fontaine
Christa McAuliffe Center (Framingham)	Dr. Mary Liscombe
Clay Center Observatory (Brookline)	Mr. Ronald Dantowitz

The representative of each organization acts as a liaison for MASGC at their institution, which includes publicizing Space Grant activities and helping to screen and nominate students and programs for MASGC funding.